

men of the more competent type is becoming more serious every day, because the demand for skilled mechanics increases with the introduction of improved machine tools, and the problem is, in what way can we hope to insure a supply of thoroughly well-trained competent machinists.

It will of course be said by a certain class of critics that the workshop is the only place in which such a training must be obtained, but this is not the opinion of some of the best-informed American engineers.

A movement is on foot in America for securing a special training, by the founding of schools for the purpose of training machinists thoroughly from the earliest stages upwards. On this point a most valuable paper has recently been contributed to the American Society of Mechanical Engineers on "The Education of Machinists, Foremen, and Mechanical Engineers," by Prof. M. P. Higgins, of Worcester, Mass., U.S.A., in which, after recommending the formation of workshop schools, he says, "America has made a strong beginning as an export nation of high grade machines. There are many evidences of keen interest amounting to surprise and alarm on the part of our European rivals. It is interesting to note their efforts to discover the cause of this sudden uprising of a new and evidently powerful rival in a field heretofore all their own.

"The cause of our supremacy," he says, "has not been altogether the superiority of our high-class engineers, for they also have highly educated engineers. But it has largely resulted from the superior character and make-up of our *mechanics*, which has come from the chance which America gives the workmen, and in the liberal and wise provisions to train American boys, giving each a fair field and open path to rise from one plane to a higher one, as his abilities and circumstances may warrant.

"We must not allow ourselves to rest secure in the belief that our Old World competitors will be slow to discern this cause or slow to profit by the example. Therefore, what more potent steps can we take for our protection than to keep this path open from the bottom, and to better our methods all the way up through the successive stages?"

*In what way may the schools help to more effectually prepare our youths for the task which lies before them?*

*The Elementary School.*—I begin at the elementary school because the problem before us is one which can only be solved by laying a good foundation at the very beginning, and proceeding upwards by a properly organised system of training towards the result which we desire to obtain.

Our British system of elementary school training is probably equal to that of any country in the world, but we have to regret the very early age at which the majority of boys pass away from the influences of the school. This is in part due no doubt to the feeling on the part of parents, especially of the lower classes, that after having passed the ordinary standards there is no necessity for any further stay at school, as the subjects taught are assumed to have little or nothing to do with the immediate requirements of life outside the school.

The opening in many large centres of Higher Grade Schools, in which pupils who have reached the higher standards may receive instruction at low fees, in science and in manual work, has been generally productive of much good, by retaining in the school pupils who would otherwise have left at an earlier age; and in these Higher Grade Schools pupils of exceptional ability, as tested by the ordinary system of examinations, have been selected, and in many cases specially trained, for scholarships or for examinations admitting them to the universities. But an idea is beginning to dawn upon us that perhaps, after all, there may be, among the very large majority of boys who are never among those selected to receive any special training to pass university examinations, and who have no special aptitude in the direction of acquiring book knowledge, much real ability in other directions, in fact, that they may be, as it were, a kind of unworked mine of possibilities and resources.

Hitherto they have been looked upon as the wasters of the school, but it is almost certain that the great inventors and mechanics of our time have not usually come from the class of boys who are looked upon as the most successful students. Usually the "clever boy" is the one who, by his ability, in the particular direction by which the schools measure ability, succeeds in escaping from the workshop and in doing, as he would consider, better for himself by obtaining other employment.

Every Higher Grade School in which work is carried to the extent of providing school laboratories for, say, chemistry and physics, which, by the way, is a very good and necessary provision, should provide also an alternative course in a school workshop for the type of boy well known to teachers whose tendencies are more mechanical than scientific, who would be likely to make much more progress if trained in a workshop than in a chemical laboratory; and who would certainly pay for such training.

Every teacher who has had experience with the teaching of science to boys knows that the class consists of two distinct types; first, those who are fitted by careful training to become successful students, and to take a more or less high position in public examinations, who in fact are aiming at passing some examination as a means to their future progress; and secondly, those who have no prospect of such success, and whose future success will depend, if they succeed at all, upon other qualifications.

Now this latter class includes the majority of the pupils. They contain also the class from which will be drawn in the future the workers, and in some cases the leaders, in our industries, and these boys have, equally with the other boys, a reasonable claim upon all that the school can do for them to prepare them for their future. To meet then the case of these boys the workshop course should be an altogether different course from that hitherto provided. It should be equipped with as much care and as much completeness in its way, for the purpose of training this type of boy, as is the chemical or physical laboratory, and the educational value of such training need be in no sense inferior to that of any other course of study.

It is assumed that boys in such a school have already done a woodwork course, and if so they would here receive an iron-work course in a workshop supplied with a good selection of tools, including some small but good types of machine tools driven by a gas engine or electric motor. The effect of providing such a course of instruction would be to select, by a natural system, the type of boy likely to profit by the training received, and to retain these boys for a much longer period than would otherwise be possible. But the success of such school workshops would depend largely upon the course of instruction given, and upon the quality of the teacher giving it. The course should include practical work in the shops, the arithmetic of machines, geometry, machine drawing and design, and elementary applied mechanics. Each of these subjects is capable of indefinite extension, but it is of great importance that the early teaching should lay a good foundation upon which the future may be built, and that nothing should be learned which will afterwards require to be unlearned.

#### UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

It is announced that a copy of the charter and statutes which are to govern the new University of Birmingham, has been laid on the table of the House of Commons. This contains a list of honorary and other officers covered by the terms of the charter, but only three persons are mentioned who have been definitely appointed to positions in the new University. The first Chancellor will be Mr. Chamberlain. No name is associated with the office of Principal, which is to be a Crown appointment, made through the Lord President of the Council, but the Vice-Principal nominated is Dr. R. S. Heath, who has been acting Principal of Mason University College. The appointment of the first Dean of the Faculty of Medicine has been conferred on Dr. B. C. A. Windle, F.R.S.

#### SOCIETIES AND ACADEMIES.

LONDON.

**Royal Society,** December 7, 1899.—"Gold Aluminium Alloys." By C. T. Heycock, F.R.S., and F. H. Neville, F.R.S.

The freezing point curve for mixtures of gold and aluminium consists of seven branches, each branch corresponding to equilibrium between liquid and the first solid which forms as the system cools. Seven substances can also be detected by a microscopic examination of the solid alloys. They are gold,  $Au_4Al$ ,  $Au_5Al_2$ , or perhaps  $Au_3Al_3$ ,  $Au_3Al$ , a body which is probably  $AuAl$ , Roberts-Austen's purple  $AuAl_2$ , and aluminium. With the